GE 348

ENGINEERING ECONOMICS

MIDTERM

FEBRUARY, 1997

- Open textbook
- One 8 ½" x 11" sheet of notes
- Neatness counts a lot!
- Show all work in design note format

Question	Marks	Marks Obtained
1	10	10
2	10	10
3	15	15
4	15	10
5	25	25
6	25	25
	100%	95

4

NAME: _Reid Jov Melk_

STUDENT #: _=250 616_

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1. At an interest rate of ... amount?

(10)
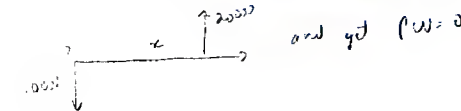
$$P_i(1+i)^n = F$$
$$10000(1+0.05)^n = 20000$$
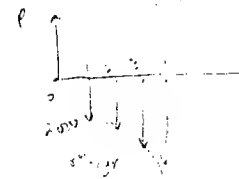$$(1.05)^n = 2 \qquad n\ln(1.05) = \ln 2$$

$$\boxed{n = 9.01 \text{ years}}$$

9.01

Answer

2. Tuition costs are expected to inflate at the rate of 8 percent per year. The first year's tuition is due 1 year from now and will be $2000. A fund is to be set up today to cover tuition costs for 4 years in an account that will earn interest at rate i. How large must the fund be if $i = 5\%$?

(10)

note: P is a payment into the fund while tuition is a payment out

$$P - A\left[\frac{1 - \dots}{\dots}\right] = 0$$

$$P = 2000\left[\frac{1 - (1+0.08)^4(1+0.05)^{-4}}{0.05 - 0.08}\right]$$

$$\boxed{P = 7951.64}$$

7951.64

Answer

3. For a finance charge stated as 1.75 percent per month, what are the corresponding nominal and effective interest rates?

$\text{nominal rate} = (1.75) \times 12 = 21\%$

$\text{effective rate} = (1 + i/r_j)^n - 1 = (1 + 0.0175)^{12} - 1 = 23.14\%$

(15)

nominal: 21%

effective: 23.14%

a)	21.0%	✓
b)	23.14%	

Answer

4. A 10-year corporate bond has a face value of $1000 and a coupon rate of 8 percent payable semiannually. A prospective buyer desires to earn a nominal rate of 12 percent on investments. What purchase price would the buyer be willing to pay?

(15)

Annual payment: $A = 1000 \left(\frac{0.08}{2} \right) = 40$
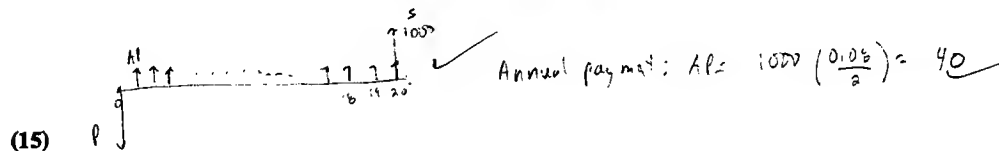
set $PW = 0$ to find breakeven at MARR = 12%

$-P + A \left[\frac{(1+i)^n - 1}{i(1+i)^n} \right] + P(1+i)^{-n} = 0$

$-P - 40 \left[\frac{(1+0.06)^{20} - 1}{0.06(1+0.06)^{20}} \right] - 1000(1+0.12)^{-10} = 0$

$P = 780.77$

10
780.77

Answer

5.

Data for three alternative investment plans are listed below.				
Alternative	Investment	Salvage Value	Life, Years	Annual Net Cash Flow
X	$6,000	$0	3	$2600
Y	12,000	3000	6	2500
Z	18,000	0	6	4000

When the minimum attractive rate of return is 10 percent, which alternative should be selected if the individual alternatives are mutually exclusive?

mutually exclusive ⇒ use IIRR

(25)
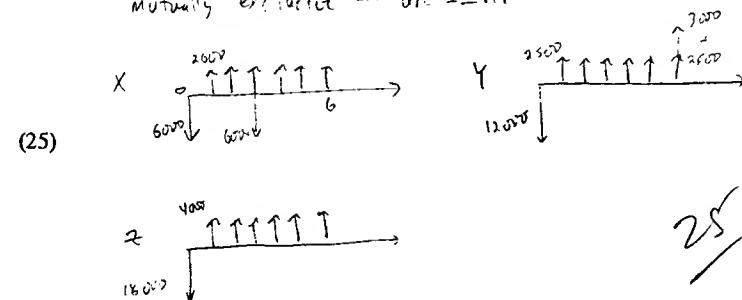
set PW = 0 in all cases

$IRR_{0 \to x}: \quad -6000 + 2600 \left[\frac{(1+i)^6 - 1}{i(1+i)^6} \right] - 6000(1+i)^{-3} = PW$

try $i = 10\%$ $PW = 815.79$ ∴ IIRR$_{0 \to x}$ is > MARR so **tut**

$IRR_{x \to y}: \quad -6000 - 100 \left[\frac{(1+i)^6 - 1}{i(1+i)^6} \right] + 6000(1+i)^{-3} + 3000(1+i)^{-6} = PW$

try $i = 10\%$ $PW = -274.22 < 0$ ∴ IIRR$_{x \to y}$ is < MARR so **keep X**

$IRR_{x \to z} \quad -12000 + 1400 \left[\frac{(1+i)^6 - 1}{i(1+i)^6} \right] + 6000(1+i)^{-3} = PW$

try $i = 10\%$ $PW = -1394.75 < 0$

∴ IIRR$_{x \to z}$ < MARR so keep X

X

Answer

6. A parcel of land adjacent to a proposed highway exit is deemed likely to increase in value. It can be purchased now for $80,000 and is expected to be worth $150,000 within 5 years. During that period it can be rented for pasture at $1500 per year. Annual taxes are presently $850 and will likely remain constant. What rate of return will be earned on the investment if the estimates are accurate?

(25)
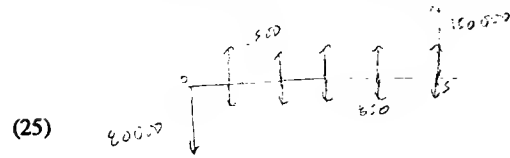
Find rate of return

set $PW = 0$ if possible

annual income $= 1500 - 850 = 650$

$-80\,000 + 650\, P(P/A, i, 5) + 150\,000\, P(P/F, i, 5) = PW$

$-80\,000 + 650 \left[\dfrac{(1+i)^5 - 1}{i(1+i)^5} \right] + 150\,000\, (1+i)^{-5} = PW$

try $i = 20\%$ $PW =$ negative
   $i = 10\%$ $PW =$ positive

note solve $-80\,000 + 150\,000(1+i)^{-5} = 0$ find as a guess

$\Rightarrow i \approx 13.4\%$

try $i = 13.4\%$ $PW =$ positive
try $i = 13.5\%$ $PW =$ positive
try $i = 13.7\%$ $PW =$ positive
try $i = 14\%$ $PW = 134.6$
try $i = 14.1\%$ $PW = -207$

$\boxed{14\,\%}$
Answer

Bonus Question - Wealthy Barber

5%   In point form, outline the principles recommended in the Wealthy Barber to financial independence.

- Dollar cost averaging - buy with same amount of money
- Forced savings ✓ get money taken out of account directly
- Insurance - only keep enough to sustain standard of living
  - don't keep any if you're single
  - decrease as you get old
- Real-estate is always a good long-term investment
- START EARLY ✓
- Always have a will
- Invest 10% of everything you make ✓
- Pay yourself first ✓
- Mutual funds are good and worth doing research into
- Equity outpays debt ⇒ invest in a company rather than loan money
- Pay off high interest debt like credit cards ⇒ this is equivalent to making a good investment